



Stratospheric trace gas measurements by ASUR during PAVE

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Outline

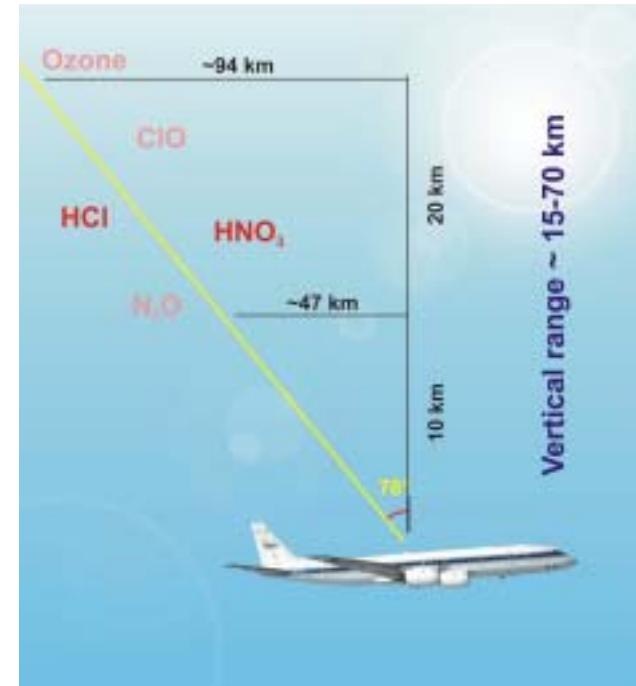
- Introduction
 - ASUR instrumental set-up
- PAVE campaign 2005
 - Measurements of HCl, ClO, HNO₃, Ozone, N₂O
 - First estimates of denitrification
 - HCN measurements



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ASUR features, set-up, and geometry



- Detection of emission lines from molecular rotational transitions
- Frequency range: 604.3 – 662.3 GHz
- Vertical information derived from pressure broadening

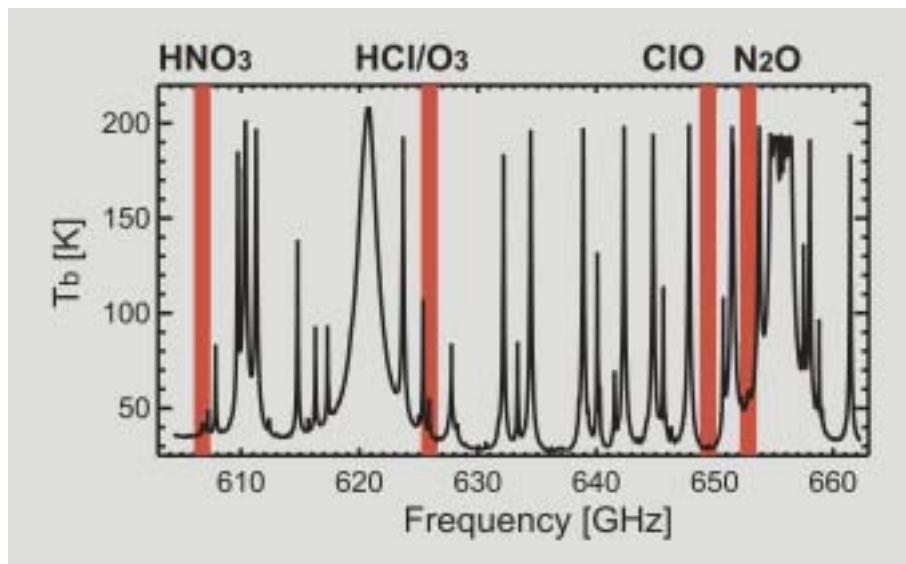


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ASUR species

- Detectable molecules: HNO_3 , N_2O , HCl , ClO , O_3 , NO , HCN , HO_2 , H_2O , CH_3Cl
- Profile retrieval possible from $\sim 15 - 70$ km altitude using data from two spectrometers
- Quasi-operational stratospheric profile retrieval established for HNO_3 , N_2O , HCl , ClO , O_3



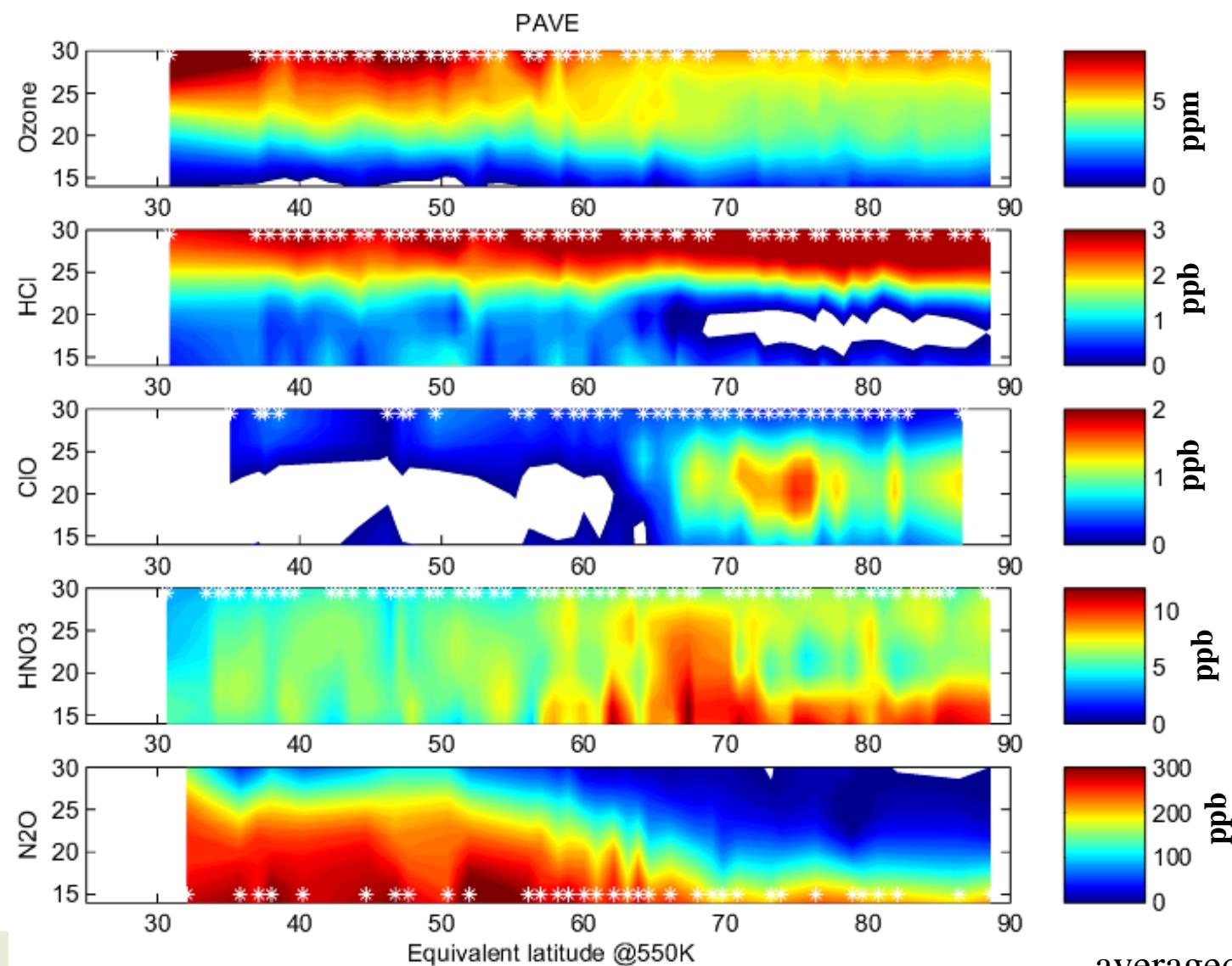
- Vertical resolution: 5 – 10 km in lower stratosphere
- Horizontal resolution: typically 12 – 40 km



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PAVE



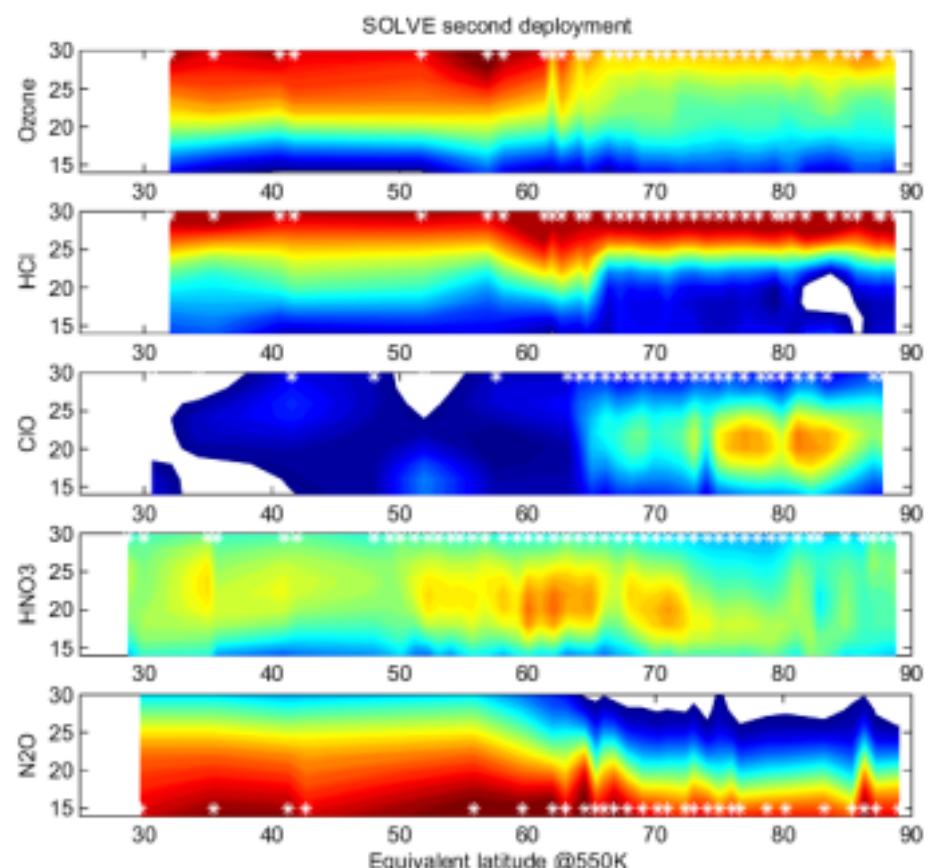
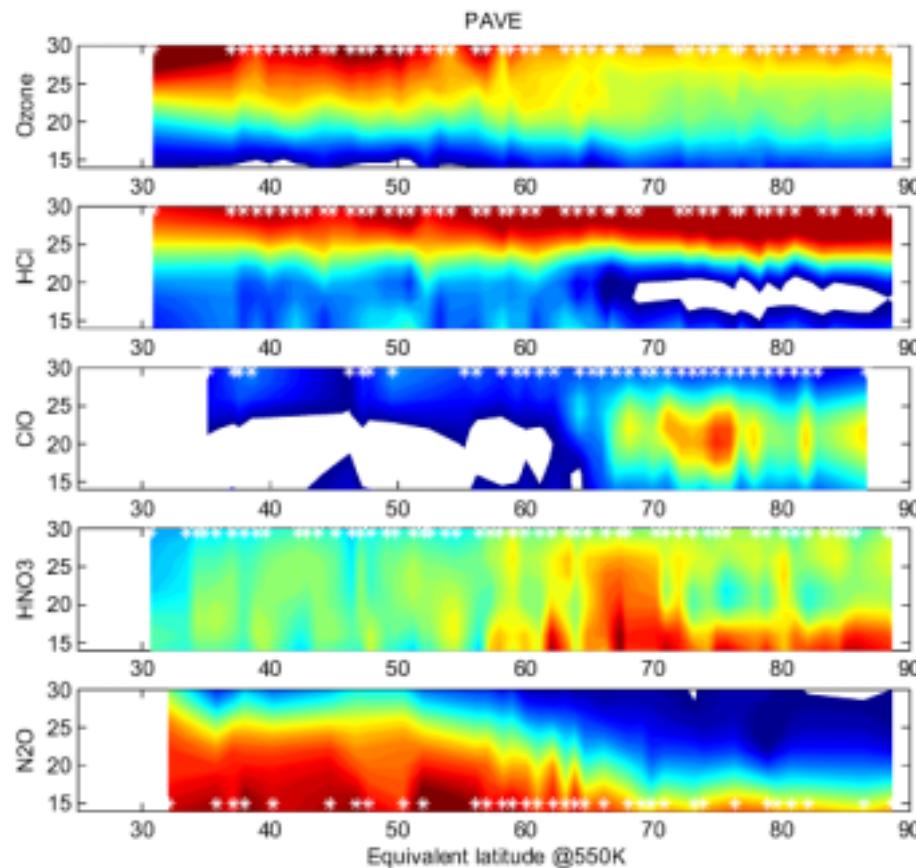
averaged within 1°



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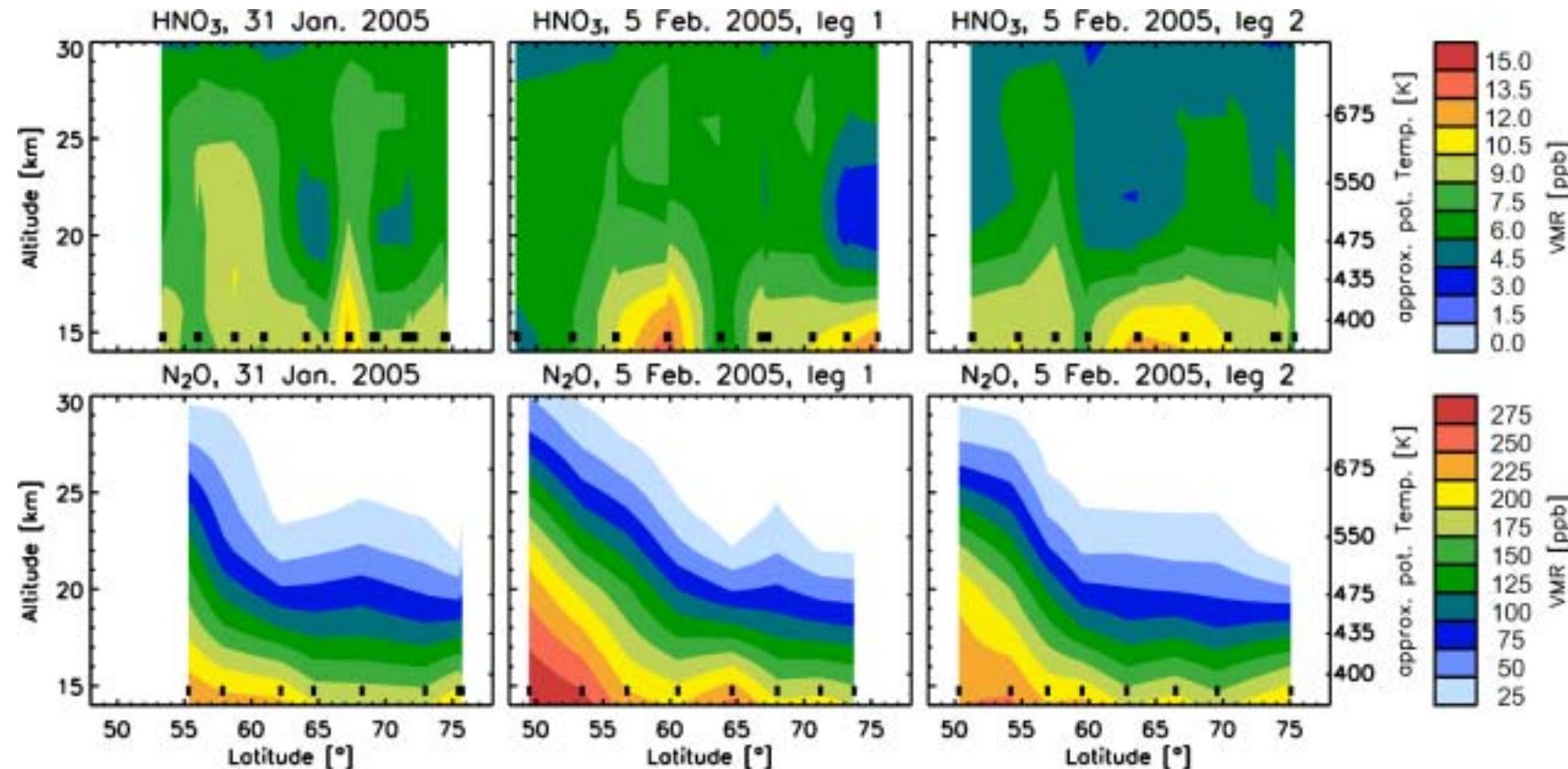
PAVE - SOLVE



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Denitrification



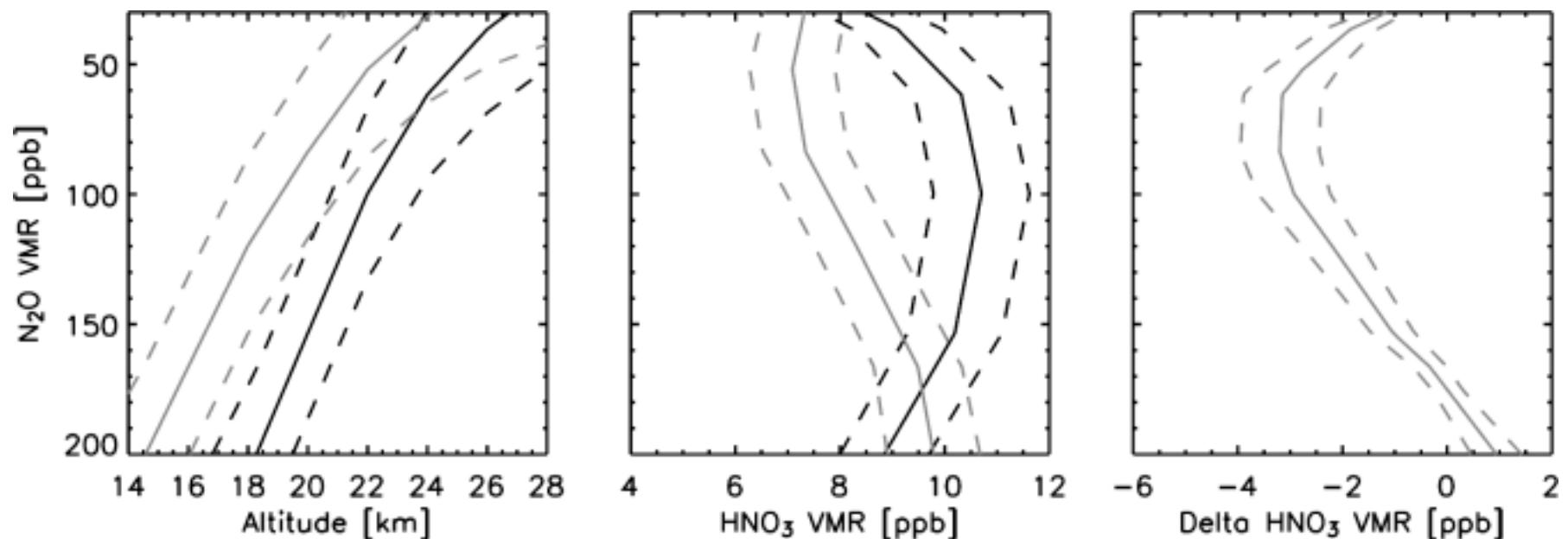
Kleinböhl et al., GRL 2005



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Denitrification



black: 2 – 5 Dec 1999,
gray: 24 Jan – 7 Feb 2005

black: mean HNO_3^* ,
gray: 24 Jan – 7 Feb 2005

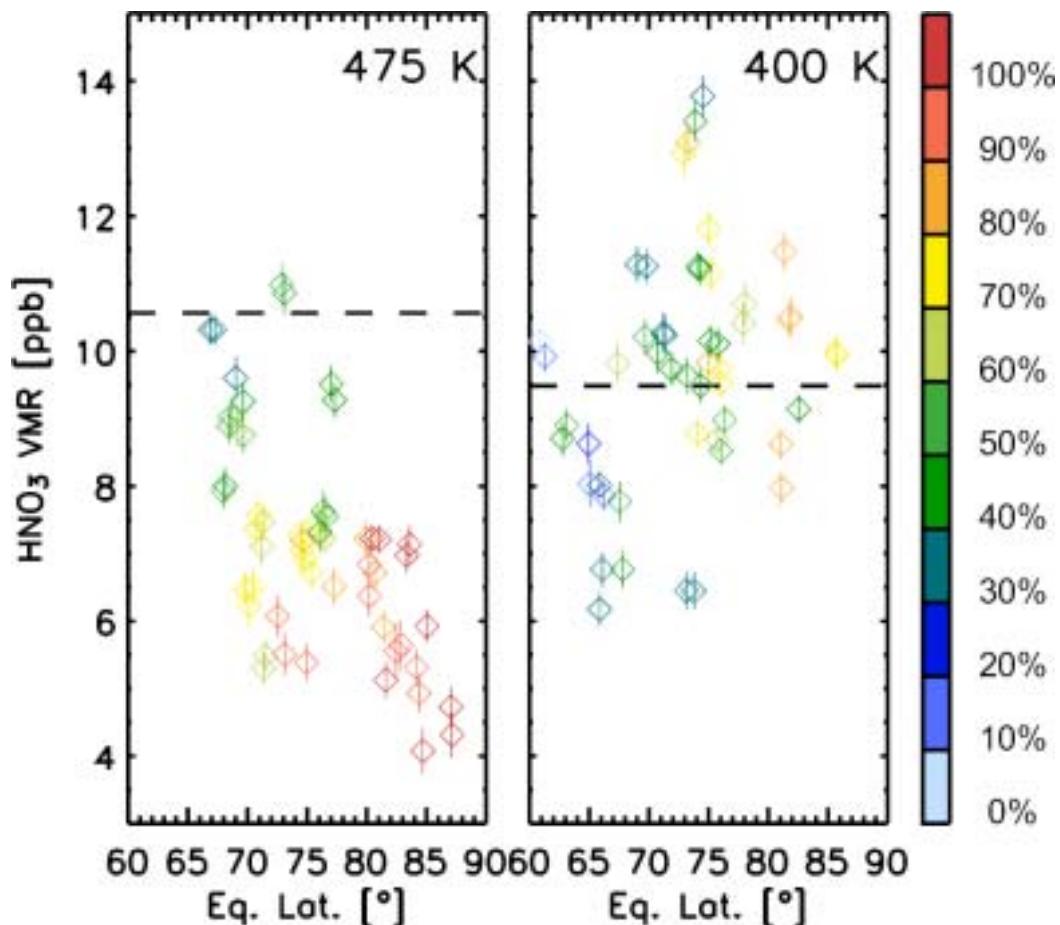
Kleinböhl et al., GRL 2005



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Denitrification



20-day back trajectory
calculations:

Dashed line: HNO₃*

Colors: fraction of time
air parcels experienced
T below T_{NAT}

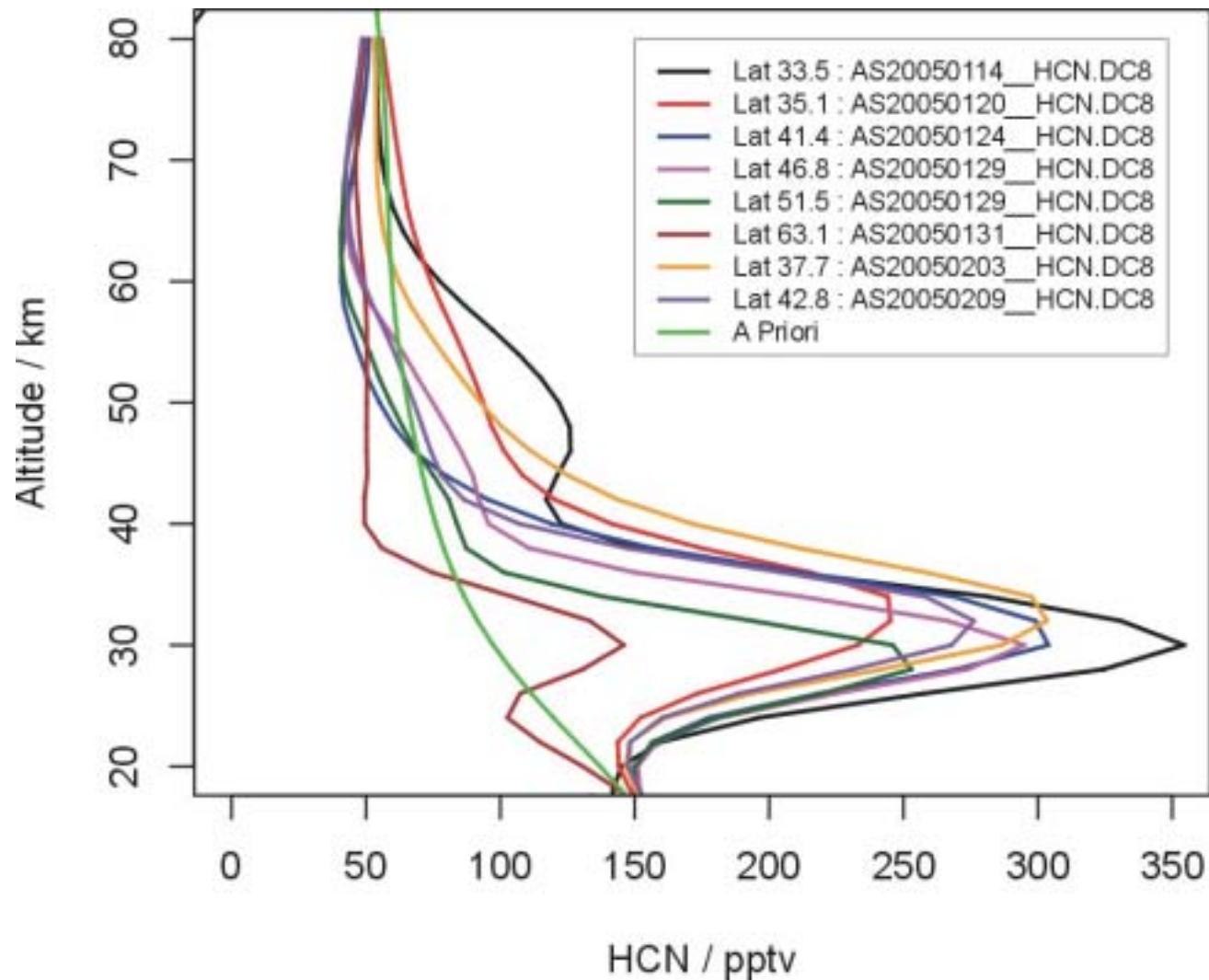
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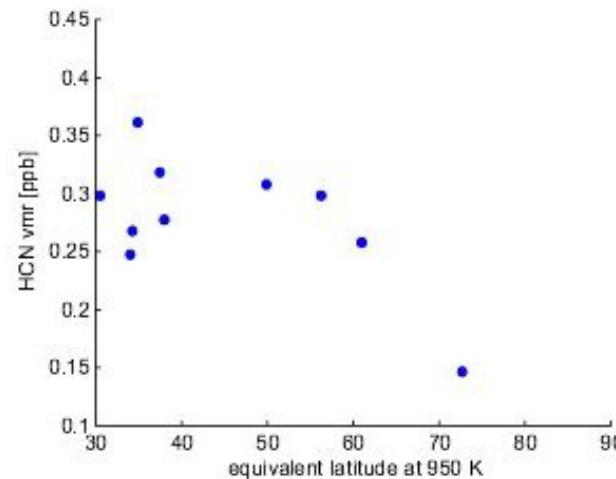
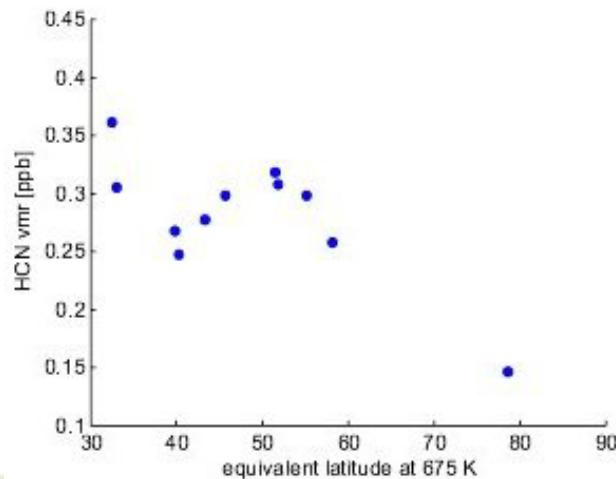
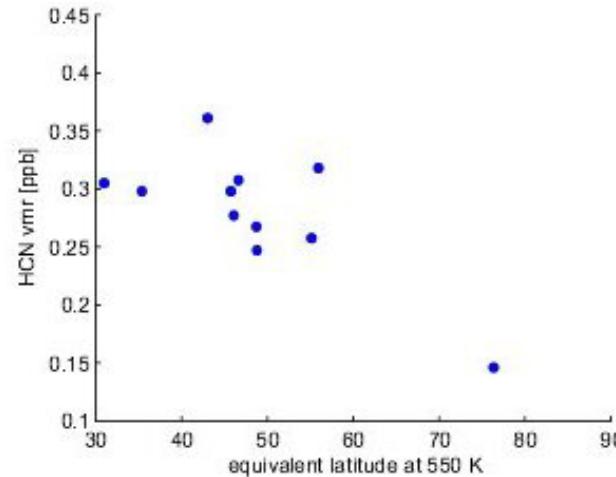
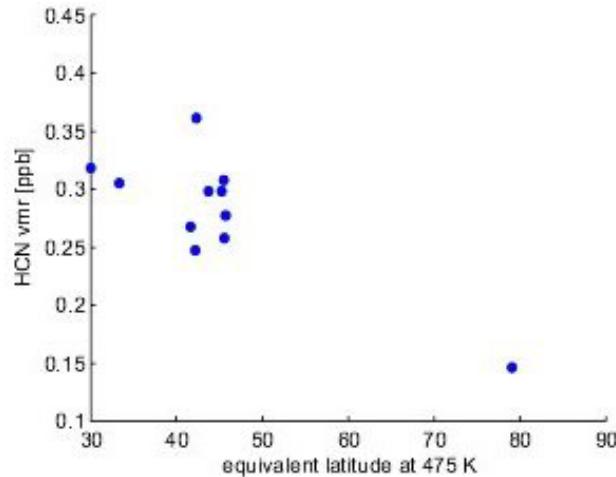
HCN



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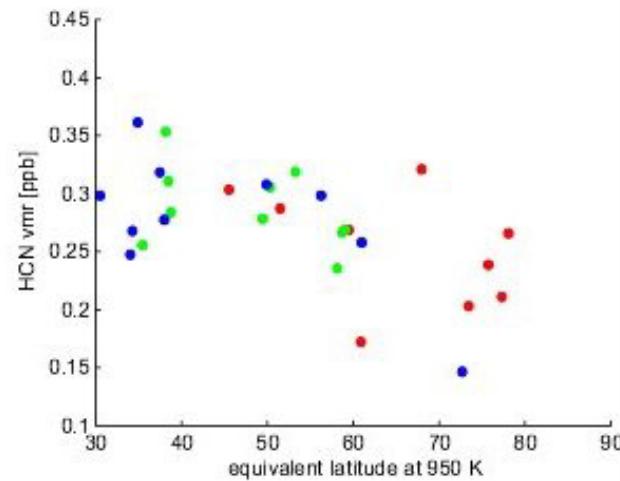
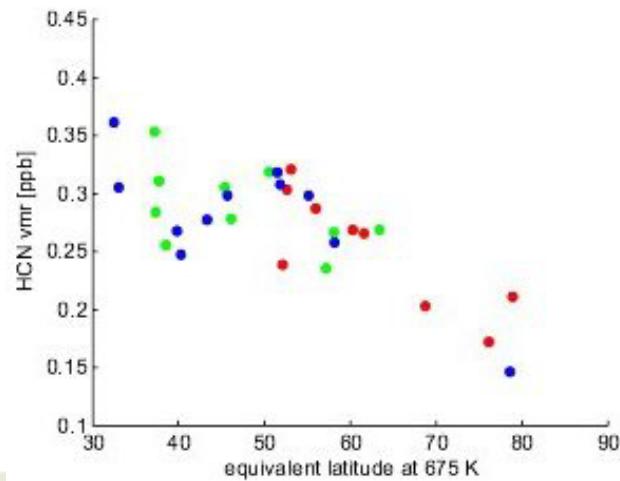
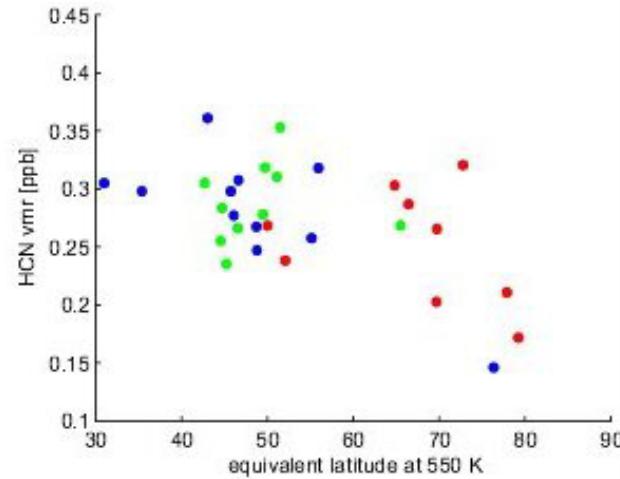
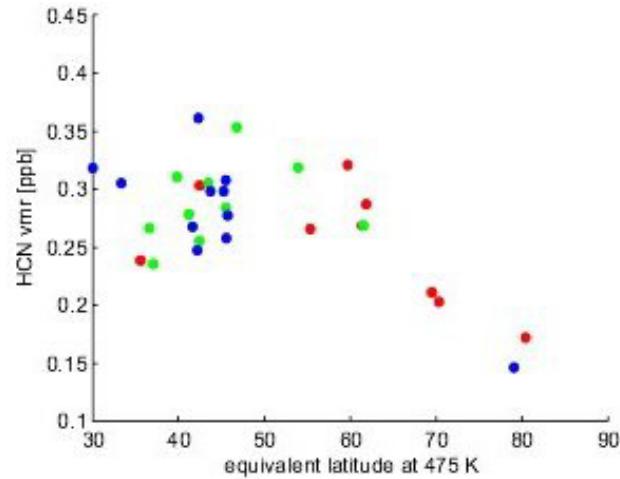
HCN



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HCN



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Summary

- Results
 - Chlorine activation of 1.8 ppb
 - HCl below detection limit within parts of the vortex
 - Areas of low HNO_3 vmr within the vortex (between 20 – 25 km)
 - Very high HNO_3 vmr in below 20 km
- Denitrification
 - PAVE: 3.1 ± 0.7 ppb around 20 km
 - SOLVE: 4 ± 2.1 ppb to 5.3 ± 2.7 ppb (19 – 20.5 km)
- HCN
 - Distinct peak around 30 km



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